

INTERNATIONAL STANDARD



Specifications for particular types of winding wires –
Part 0-3: General requirements – Enamelled round aluminium wire

(<https://standards.iteh.ai>)

Document Preview

[IEC 60317-0-3:2024](https://standards.iteh.ai/catalog/standards/iec/8c3342c6-7f62-4c95-83f9-67c9da698a88/iec-60317-0-3-2024)

<https://standards.iteh.ai/catalog/standards/iec/8c3342c6-7f62-4c95-83f9-67c9da698a88/iec-60317-0-3-2024>





THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2024 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

International
Standards
Document Preview
standards.iteh.ai

[IEC 60317-0-3:2024](https://standards.iteh.ai/catalog/standards/iec/8c3342c6-7f62-4c95-83f9-67c9da698a88/iec-60317-0-3-2024)

<https://standards.iteh.ai/catalog/standards/iec/8c3342c6-7f62-4c95-83f9-67c9da698a88/iec-60317-0-3-2024>



IEC 60317-0-3

Edition 4.0 2024-09
REDLINE VERSION

INTERNATIONAL STANDARD



Specifications for particular types of winding wires –
Part 0-3: General requirements – Enamelled round aluminium wire

(<https://standards.iteh.ai>)
Document Preview

[IEC 60317-0-3:2024](https://standards.iteh.ai/catalog/standards/iec/8c3342c6-7f62-4c95-83f9-67c9da698a88/iec-60317-0-3-2024)

<https://standards.iteh.ai/catalog/standards/iec/8c3342c6-7f62-4c95-83f9-67c9da698a88/iec-60317-0-3-2024>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.060.10

ISBN 978-2-8322-9701-8

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	2
1 Scope.....	7
2 Normative references	7
3 Terms, definitions, general notes, and appearance.....	7
3.1 Terms and definitions.....	7
3.2 General notes	8
3.2.1 Methods of test.....	8
3.2.2 Winding wire.....	9
3.3 Appearance	9
4 Dimensions.....	9
4.1 Conductor diameter	9
4.2 Out of roundness of conductor	11
4.3 Minimum increase in diameter due to the insulation and the bonding layer.....	11
4.3.1 Enamelled wires without a bonding layer	11
4.3.2 Enamelled wires with a bonding layer	11
4.4 Maximum overall diameter	11
4.4.1 Enamelled wires without a bonding layer	11
4.4.2 Enamelled wires with a bonding layer	12
5 Electrical resistance	12
6 Elongation	12
7 Springiness	12
8 Flexibility and adherence.....	12
8.1 Mandrel winding test (nominal conductor diameters up to and including 1,600 mm).....	12
8.2 Stretching test (nominal conductor diameters over 1,600 mm)	13
8.3 Jerk test (nominal conductor diameters up to and including 1,000 mm).....	13
8.4 Peel test (nominal conductor diameters over 1,000 mm)	13
9 Heat shock	13
9.1 Nominal conductor diameters up to and including 1,600 mm	13
9.2 Nominal conductor diameters over 1,600 mm.....	13
10 Cut-through	13
11 Resistance to abrasion	13
12 Resistance to solvents.....	13
13 Breakdown voltage	14
13.1 General.....	14
13.2 Nominal conductor diameters up to and including 2,500 mm	14
13.3 Nominal conductor diameters over 2,500 mm.....	14
14 Continuity of insulation (nominal conductor diameters up to and including 1,600 mm).....	14
15 Temperature index	15
16 Resistance to refrigerants.....	15
17 Solderability	15
18 Heat or solvent bonding.....	15
19 Dielectric dissipation factor.....	16

20	Resistance to transformer oil	16
21	Loss of mass	16
23	Pin hole test	16
30	Packaging	16
Annex A (informative) Dimensions for intermediate nominal conductor diameters		
(R 40)	17
A.1	General.....	17
A.2	Enamelled wires without a bonding layer.....	17
A.3	Enamelled wires with a bonding layer	18
Annex B (normative) Method for the calculation of linear resistance..... 19		
Annex C (informative) Resistance		
		20
Bibliography..... 21		
Table 1	– Dimensions of enamelled wires (R 20).....	10
Table 2	– Dimensions of enamelled wires with a bonding layer (R 20)	11
Table 3	– Elongation	12
Table 4	– Mandrel winding	12
Table 5	– Heat shock	13
Table 6	– Breakdown voltage	14
Table 7	– Breakdown voltage	15
Table 8	– Continuity of insulation	15
Table A.2	– Dimensions of enamelled wires with a bonding layer (R 40)	18
Table C.1	– Electrical resistances	20

[IEC 60317-0-3:2024](https://standards.iteh.ai/catalog/standards/iec/8c3342c6-7f62-4c95-83f9-67c9da698a88/iec-60317-0-3-2024)

<https://standards.iteh.ai/catalog/standards/iec/8c3342c6-7f62-4c95-83f9-67c9da698a88/iec-60317-0-3-2024>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 0-3: General requirements – Enamelled round aluminium wire

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60317-0-3:2008+AMD1:2013+AMD2:2019 CSV. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60317-0-3 has been prepared by IEC technical committee 55: Winding wires. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2008, Amendment 1:2013 and Amendment 2:2019. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Revision to Clause 7, designating the test as inappropriate;
- b) Revision to Clause 10, designating the test as inappropriate.

The text of this International Standard is based on the following documents:

Draft	Report on voting
55/2049/FDIS	55/2054/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60317 series, published under the general title *Specifications for particular types of winding wires*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent. IEC takes no position concerning the evidence, validity, and scope of this patent right.

The holder of this patent right has assured IEC that s/he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with IEC. Information may be obtained from the patent database available at patents.iec.ch/.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those in the patent database. IEC shall not be held responsible for identifying any or all such patent rights.

This part of IEC 60317 is one of a series that deals with insulated wires used for windings in electrical equipment. The series has three groups describing

- 1) winding wires and test methods (IEC 60851);
- 2) specifications for particular types of winding wires (IEC 60317);
- 3) packaging of winding wires (IEC 60264).

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 60317-0-3:2024](https://standards.iteh.ai/catalog/standards/iec/8c3342c6-7f62-4c95-83f9-67c9da698a88/iec-60317-0-3-2024)

<https://standards.iteh.ai/catalog/standards/iec/8c3342c6-7f62-4c95-83f9-67c9da698a88/iec-60317-0-3-2024>

SPECIFICATIONS FOR PARTICULAR TYPES OF WINDING WIRES –

Part 0-3: General requirements – Enamelled round aluminium wire

1 Scope

This part of IEC 60317 specifies the general requirements of enamelled round aluminium winding wires with or without a bonding layer.

The range of nominal conductor diameters is given in the relevant specification sheet.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60172, *Test procedure for the determination of the temperature index of enamelled and tape wrapped winding wires*

IEC 60317 (all parts), *Specifications for particular types of winding wires*

IEC 60851 (all parts), *Winding wires – Test methods*

ISO 3, *Preferred numbers – Series of preferred numbers*

ASTM B233-97, *Standard Specification for Aluminum 1350 Drawing Stock for Electrical Purposes*

EN 1715-2, *Aluminium and aluminium alloys – Drawing stock – Part 2: Specific requirements for electrical applications*

3 Terms, definitions, general notes, and appearance

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions ~~and general notes~~ apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1.1

bonding layer

material which is deposited on an enamelled wire, and which has the specific function of bonding wires together

3.1.2**class**

thermal performance of a wire expressed by the temperature index and the heat shock temperature

3.1.3**coating**

material which is deposited on a conductor or wire by a suitable means and then dried and/or cured

3.1.4**conductor**

bare metal after removal of the insulation

3.1.5**crack**

opening in the insulation which exposes the conductor to view at the stated magnification

3.1.6**dual coating**

~~insulation composed of two different materials, an underlying and a superimposed coating~~

3.1.6**enamelled wire**

wire coated with an insulation of cured resin

3.1.7**grade**

range of thickness of the insulation of a wire

3.1.8**insulation**

~~coating or covering on the conductor with the specific function of withstanding voltage~~

3.1.9**nominal conductor ~~dimension~~ diameter**

designation of the conductor size in accordance with the IEC 60317 series

3.1.10**normal vision**

20/20 vision, with corrective lenses, if necessary

3.1.11**winding wire**

wire used for winding a coil to provide a magnetic field

3.1.12**wire**

conductor coated or covered with an insulation

3.2 General notes**3.2.1 Methods of test**

All methods of test to be used for this part of IEC 60317, independent of the class of wire, are given in the IEC 60851 series.

The clause numbers used in this document are identical with the respective test numbers of the IEC 60851 series.

In case of inconsistencies between the publication on methods of test and this document, IEC 60317-0-3 shall prevail.

Where no specific range of nominal conductor diameters is given for a test, the test applies to all nominal conductor diameters covered by the specification sheet.

Unless otherwise specified, all tests shall be carried out at a temperature from 15 °C to 40 °C and a relative humidity of 25 % to 75 %. Before measurements are made, the specimens shall be preconditioned under these atmospheric conditions for a time sufficient to allow the specimens to reach stability.

The wire to be tested shall be removed from the packaging in such a way that the wire will not be subjected to tension or unnecessary bends. Before each test, sufficient wire should be discarded to ensure that any damaged wire is not included in the test specimens.

3.2.2 Winding wire

See the relevant specification sheet.

In addition, when reference is made to a winding wire according to a standard of the IEC 60317 series mentioned under Clause 2, the following information is given in the description:

- reference to IEC specification;
- nominal conductor diameter in millimetres;
- grade.

EXAMPLE IEC 60317-1 – 0,500 Grade 2.

3.3 Appearance

The film coating shall be essentially smooth and continuous, free from streaks, blisters and foreign material when examined with normal vision, as wound on the original spool or reel.

When agreed upon between the user and supplier, examination using 6× to 10× magnification shall be used for wires with a nominal diameter less than 0,10 mm.

4 Dimensions

4.1 Conductor diameter

The series of preferred nominal conductor diameters shall correspond to series R 20 according to ISO 3. The actual values and their tolerances are given in Table 1 and Table 2.

The series of intermediate diameters from which the user may select intermediate nominal conductor diameters, when required for technical reasons, shall correspond to series R 40 according to ISO 3. The actual values and their tolerances are given in Annex A.

The conductor diameter shall not differ from the nominal diameter by more than the limit given in Table 1 or Table 2.

For intermediate nominal conductor diameters, the minimum increase figure corresponding to the next larger nominal conductor diameter applies.

Table 1 – Dimensions of enamelled wires (R 20)

Nominal conductor diameter	Conductor tolerance ±	Minimum increase due to the insulation			Maximum overall diameter		
		mm			mm		
mm	mm	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3
0,250	0,004	0,017	0,032	0,048	0,281	0,297	0,312
0,280	0,004	0,018	0,033	0,050	0,312	0,329	0,345
0,315	0,004	0,019	0,035	0,053	0,349	0,367	0,384
0,355	0,004	0,020	0,038	0,057	0,392	0,411	0,428
0,400	0,005	0,021	0,040	0,060	0,439	0,459	0,478
0,450	0,005	0,022	0,042	0,064	0,491	0,513	0,533
0,500	0,005	0,024	0,045	0,067	0,544	0,566	0,587
0,560	0,006	0,025	0,047	0,071	0,606	0,630	0,653
0,630	0,006	0,027	0,050	0,075	0,679	0,704	0,728
0,710	0,007	0,028	0,053	0,080	0,762	0,789	0,814
0,800	0,008	0,030	0,056	0,085	0,855	0,884	0,911
0,900	0,009	0,032	0,060	0,090	0,959	0,989	1,018
1,000	0,010	0,034	0,063	0,095	1,062	1,094	1,124
1,120	0,011	0,034	0,065	0,098	1,184	1,217	1,248
1,250	0,013	0,035	0,067	0,100	1,316	1,349	1,381
1,400	0,014	0,036	0,069	0,103	1,468	1,502	1,535
1,600	0,016	0,038	0,071	0,107	1,670	1,706	1,740
1,800	0,018	0,039	0,073	0,110	1,872	1,909	1,944
2,000	0,020	0,040	0,075	0,113	2,074	2,112	2,148
2,240	0,022	0,041	0,077	0,116	2,316	2,355	2,392
2,500	0,025	0,042	0,079	0,119	2,578	2,618	2,656
2,800	0,028	0,043	0,081	0,123	2,880	2,922	2,961
3,150	0,032	0,045	0,084	0,127	3,233	3,276	3,316
3,550	0,036	0,046	0,086	0,130	3,635	3,679	3,721
4,000	0,040	0,047	0,089	0,134	4,088	4,133	4,176
4,500	0,045	0,049	0,092	0,138	4,591	4,637	4,681
5,000	0,050	0,050	0,094	0,142	5,093	5,141	5,186

NOTE The dimensions of intermediate nominal conductor diameters for R 40 series are given in Annex A.

Table 2 – Dimensions of enamelled wires with a bonding layer (R 20)

Nominal conductor diameter	Conductor tolerance \pm	Minimum increase underlying coating		Minimum increase bonding layer	Maximum overall diameter	
		mm			mm	
mm	mm	Grade 1B	Grade 2B	mm	Grade 1B	Grade 2B
0,250	0,004	0,017	0,032	0,013	0,300	0,316
0,280	0,004	0,018	0,033	0,013	0,331	0,348
0,315	0,004	0,019	0,035	0,014	0,369	0,387
0,355	0,004	0,020	0,038	0,015	0,413	0,432
0,400	0,005	0,021	0,040	0,016	0,461	0,481
0,450	0,005	0,022	0,042	0,016	0,514	0,536
0,500	0,005	0,024	0,045	0,017	0,568	0,590
0,560	0,006	0,025	0,047	0,017	0,630	0,654
0,630	0,006	0,027	0,050	0,018	0,704	0,729
0,710	0,007	0,028	0,053	0,019	0,788	0,815
0,800	0,008	0,030	0,056	0,020	0,882	0,911
0,900	0,009	0,032	0,060	0,020	0,987	1,017
1,000	0,010	0,034	0,063	0,021	1,091	1,123
1,120	0,011	0,034	0,065	0,022	1,214	1,247
1,250	0,013	0,035	0,067	0,022	1,346	1,379
1,400	0,014	0,036	0,069	0,023	1,499	1,533
1,600	0,016	0,038	0,071	0,023	1,702	1,738
1,800	0,018	0,039	0,073	0,024	1,905	1,942
2,000	0,020	0,040	0,075	0,025	2,108	2,146

NOTE The dimensions of intermediate nominal conductor diameters for R 40 series are given in Annex A.

4.2 Out of roundness of conductor

The difference between the minimum and maximum diameter, at any one point, shall not be more than the figure given in column 2 of Table 1 or Table 2.

4.3 Minimum increase in diameter due to the insulation and the bonding layer

4.3.1 Enamelled wires without a bonding layer

The minimum increase in diameter due to the insulation shall not be less than the values given in Table 1.

4.3.2 Enamelled wires with a bonding layer

The minimum increase in diameter due to the insulation including the bonding layer shall not be less than the values given in Table 2.

4.4 Maximum overall diameter

4.4.1 Enamelled wires without a bonding layer

The maximum overall diameter shall not exceed the values given in Table 1.

4.4.2 Enamelled wires with a bonding layer

The maximum overall diameter shall not exceed the values given in Table 2.

5 Electrical resistance

The aluminium rod being used shall comply with EN 1715-2 and ASTM B233-97.

No resistance values are specified.

By agreement between purchaser and supplier, resistance measurements may be made for nominal conductor diameters up to and including 1,000 mm. In case of such an agreement, the resistance at 20 °C shall be within the limits given in Annex C.

~~NOTE—The nominal resistance is given in Annex C.~~

6 Elongation

The elongation at fracture and tensile strength shall not be less than the value given in Table 3.

Table 3 – Elongation

Nominal conductor diameter mm		Elongation minimum	Tensile strength minimum
Over	Up to and including	%	N·mm ⁻²
–	0,400	10	90
0,400	1,000	12	90
1,000	2,000	15	80
2,000	5,000	15	70

<https://standards.iteh.ai/catalog/standards/iec/8c3342c6-7162-4c95-8319-67c9da698a88/iec-60317-0-3-2024>

7 Springiness

~~Test appropriate but no requirements specified.~~

Test inappropriate.

8 Flexibility and adherence

8.1 Mandrel winding test (nominal conductor diameters up to and including 1,600 mm)

The coating shall show no crack after the wire has been wound on a mandrel as specified in Table 4.

Table 4 – Mandrel winding

Nominal conductor diameter mm		Mandrel diameter
Over	Up to and including	
–	1,600	3d ^a

^a d is the nominal diameter of the wire.